DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

Date: 11/7/03

To: Structure Design
1. Design
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GD - North ; South ; West
2. GS File Room

Retaining Wall @ KP 11.3
Structure Name

07-Sol-1/c - 11.3
District County Route km Post

District Project Development
District Project Engineer

07-[illegible]2004
E.A. Number Structure Number

Foundation Report By: A Kadsura Dated: 2/L.103

Reviewed By: M. Kadsuratin (SD). R. Price (GS)

Foundation Plan Dated: 10/23/03 Foundation Plan Dated: 10/24/03

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- File Types and Design Loads
- Pile Lengths
- Prechilling
- Pile Load Test
- Substitution of H Piles For Concrete Piles ☐ Yes ☐ No
- Footing Elevations, Design Loads, and Locations
- Seismic Data
- Location of Adjacent Structures and Utilities
- Stability of Cuts or Fills
- Fill Time Delay
- Effect of Fills on Abutments and Bents
- Fill Surcharge
- Approach Paving Slabs
- Scour
- Ground Water
- Tremie Seals/Type D Excavation

Mounir Kadsura Branch 5
Structure Design Bridge Design Branch No.

Geotechnical Services

Rev. 08/02

State of California Business, Transportation and Housing Agency

Memorandum

To : MR. CLARK PERI
Engineering Service Center
Project Coordination Engineer – MS #9

Date : February 20, 2001

File No. : 4-SON-116-KP 11.3
Location 2 - (PM 7.0)
4277-1S3001
Slipout

From : **DEPARTMENT OF TRANSPORTATION**
ENGINEERING SERVICE CENTER
Division of Structural Foundations – MS #5
Office of Roadway Geotechnical Engineering (North)

Subject : Slide Repair Foundation Recommendations

This memorandum presents our geotechnical recommendations for the above referenced project. The recommendations contained in this report are based on results from subsurface explorations at the site of the slide.

I. BACKGROUND

During heavy January/February 1998 rainstorms, a surficial erosion and minor incipient slipout have occurred along the side hill just above the northbound shoulder of Route 116, KP 11.3, at Monte Cristo Avenue in the Town of Villa Grande (just north of the Town of Monte Rio) in Sonoma County. The head scarp of the slipout is observed as minor cracks on a private property driveway above the roadway. The approximate limits of the slipout are between Stations 10+97 and 11+17. The cause of the slide appears to be the steepness of the side hill slope (1V:0.5H) and the saturation of the hill slope during heavy rainstorms.

The design portion of this project (Location 1 – SON-1-PM 9.75 and Location 2 (SON-116-PM 7.0) was contracted out in 1998 to consultants Mark Thomas and Co., Inc. However, the consultants stopped working on this project due to lack of funds. District 4 management decided to keep the projects and prepare the final PS&E package in-house. The consultants forwarded all available incomplete design data to Caltrans.

A Foundation Report dated August 28, 2000 for Location 1 was forwarded to you. This report is written specifically for Location 2.

II. SCOPE OF WORK

Work performed for this investigation, included field mapping, reviewing existing report and information available on site geology, seismicity and subsurface soil/rock conditions, geotechnical analyses for lateral earth pressures and pile foundation parameters.

III. REGIONAL AND SITE GEOLOGY

The project is located within the Coast Ranges geomorphic province on the northeast side of the Russian River about ten miles north of Bodega Harbor. The project is approximately 6.4 miles east of the mouth of the Russian River on the Pacific Ocean coast. Bedrock in the area is the Franciscan Assemblage of Jurassic and Cretaceous age. The bedrock unit within the Franciscan Assemblage at the project shown on Armstrong's map (1980) is described as predominantly graywacke-type sandstone and shale with minor greenstone, conglomerate, chert, and limestone

IV. FAULT AND SEISMIC DATA

The project is located in the San Andreas fault system. The fault system is composed of a series of northwest trending strike slip faults. Several active faults of the San Andreas fault system are capable of producing strong shaking at the project. Table 1 below lists the faults, their closest distance to the project, their maximum credible earthquake magnitude published in the San Francisco Bay Area Seismic Hazard Map, 1995, by Lalliana Mualchin, Caltrans Office of Earthquake Engineering, and the expected peak bedrock acceleration at the project from Mualchin and Jones' compilation curves (1990).

Table 1

FAULT	*DISTANCE FROM PROJECT (km)*	*MAXIMUM CREDIBLE EARTHQUAKE*	*PEAK BEDROCK ACCELERATION*
San Andreas North	1.1 Southwest	8.0	0.73 g
San Andreas North Offshore	1.4 Southwest	7.0	0.62 g
Rodgers Creek	2.3 Northeast	7.0	0.59 g
Maacama	42 Northeast	7.25	0.61 g

V. FOUNDATION INVESTIGATION

The foundation investigation for this location consisted of drilling one power boring (P-1) using 150-mm hollow stem auger with Standard Penetration Test (SPT) sampling. Roadway Geotechnical Engineering Branch drilled boring P-1 to a depth of 15.3 m below roadway elevation in January 2001. The Log of Test Borings (LOTB) sheet will be sent to your office when completed.

Boring P-1 describes the foundation soils/rocks as approximately 4 m of intensely weathered very soft shale. The remainder of the boring describes the foundation material as intensely weathered, intensely fractured mudstone. The SPT blow counts range between 13 and 68 blows per 0.3 m.

Groundwater was not encountered in P-1 at the time of drilling (January 2001).

VI. CONCLUSIONS AND RECOMMENDATIONS

For the repair strategy of the slipout, the following three alternatives were considered:

- Reinforced soil with masonry block facing
- Combination of soil nailing and Rock Slop Protection (RSP) facing
- Soldier pile wall.

However, to minimize the impact of the project on the adjacent private property and because of right of way constraint, ease of construction, and cost effectiveness, we recommend a soldier pile wall with wood lagging to repair the slipout. Due to the close proximity of the wall to the traffic, a concrete barrier should be installed at the base of the proposed wall. See attached Exhibit A.

To collect the surface runoff, we recommend constructing a concrete lined ditch above the proposed soldier pile wall for the entire length of the wall. Consult with Hydraulic Branch for the design of the ditch and its outlets.

We recommend the following for the design of the proposed soldier pile wall:

Cantilever Soldier Pile Wall with Wood Lagging

This wall should be at least 40 m long and should be constructed between approximate Stations 10+11± and 10+51±. Based on the actual cross-sections of the site, it appears that the maximum height of the wall would be about 4.5 m. Actual height and the length of the wall should be determined by the Office of Structures Design (OSFD). Also, Design North should determine tapering both ends of the wall.

Earth Pressures

We recommend the proposed Soldier Pile Wall be designed for the following loads:

1. For active pressure against the wall, use the following:

a. A triangular pressure diagram from the top of the wall to about 0.5 m below the dredge line of the wall as shown on Figure 1 below. Use an equivalent fluid pressure of 5.5 kN/m³ per 0.3 m of depth (based on an internal friction angle $\phi = 34°$ for the structure backfill behind the wall with unit weight (γ) = 18.85 kN/m³ (120 pcf).

b. A uniform pressure diagram of 2H kPa for seismic loading assuming an average horizontal acceleration of 0.5g. See Figure 1 below.

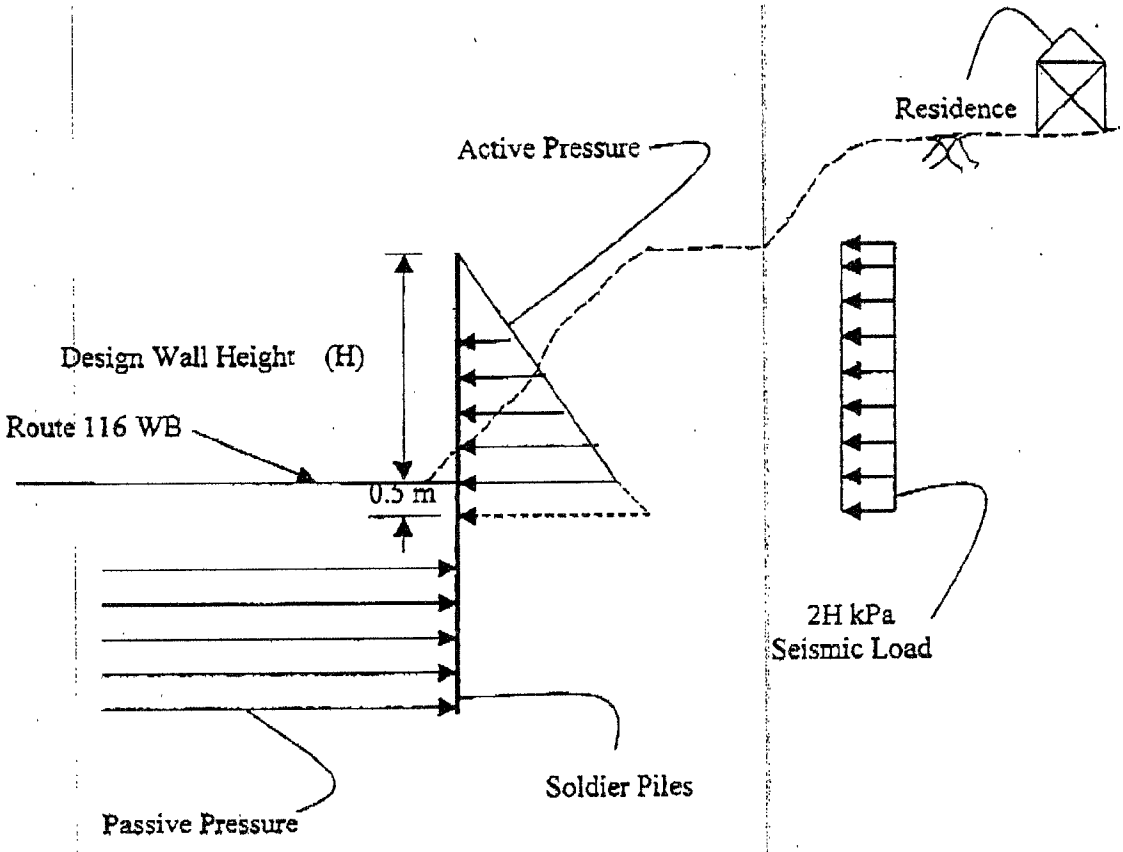


Figure 1 - Pressure Diagram

2. For passive pressure against the soldier piles, use the log spiral method (LOGSPIRAL Program) developed by O.S.D. with the following input:

a. Internal friction angle $\phi = 22°$, moist unit weight (γ) = 18.0 kN/m³ (115 pcf).

b. For design purposes, consider level ground condition in front of the wall and 1:4 sloping ground conditions with a slope of 1V:4H above the wall as shown on the attached Exhibit A.

c. Friction Factor (δ) = 2/3 ϕ.

d. An Isolation Factor of 2.5 should be used.

- Based on the boring log, we recommend the piles be embedded between the depths of 6.5 and 8 m below the ground surface into the competent soil.

- To remove the failed portion of the slipout (slough), excavate into the cut slope behind the proposed wall by at least 0.6 m and replace with structure backfill as shown on the attached Exhibit A. During construction, if the depth of the slough is determined by the Engineer to be more than 0.6 m, the depth of the excavation should be increased accordingly.

- The contractor may encounter difficulties during drilling for the soldier beam piles. This is due to the presence of sandstone just below the roadway surface.

- Although the boring log indicates a dry condition, caving occurred at the depth of 5.5 m below the ground surface during our foundation exploration. Thus, use of casing may be required. If groundwater encountered during installing the piles, installation of solider piles may require drilling and placing concrete in wet conditions if dewatering is not desirable. Specifications should require the displacement of groundwater via a closed system using a concrete pump or a tremie tube to place concrete at the bottom of the holes for soldier piles. A positive head should be maintained at all times to reduce potential for concrete segregation.

- The wall design should also consider the corrosive environment of the site. See Section VII of this report for corrosion data and refer to the attached Corrosion Data Sheet.

* * * * *

The above-recommended loadings are based on the assumption that an adequate drainage system will be provided to prevent the development of

hydrostatic pressure behind the wall. If complete drainage of the wall cannot be achieved, the active soil pressure (given above for a fully drained wall) should be increased by 6.4 kN/m^3 per 0.3 m of depth to allow for the buoyant unit weight and water pressure build-up behind the wall.

The above recommendations are based on parameters established by our field exploration, engineering judgment, and submitted wall cross-sections.

VII. CORROSION INVESTIGATION

Corrosion studies were conducted in accordance with the requirements of California Test Method No. 643. Corrosion tests were conducted on soil/rock samples obtained at various depths from the borings drilled for the above referenced three locations.

The pH values ranged from 5.8 to 6.4 and with resistivity reading ranging between 3135 ohm-cm and 7260 ohm-cm, indicating that the overburden materials at the site are moderately corrosive. We recommend the following mitigation measures in accordance with the appropriate section of the 1996 Corrosion Guidelines prepared by Caltrans Office of Materials Engineering and Testing Services (METS):

CIDH Concrete Piles

- Use Class I concrete having a minimum of 400 kg/m^3 of Type II Modified cement content for all CIDH piles.
- Provide at least 76 mm of concrete cover over the reinforcing steel.

VIII. CONSTRUCTION REQUIREMENTS

The following construction requirements should be included in the design and construction specifications for the proposed walls and mitigation measures:

A. Proposed Wall and Excavation

- Temporary cut slopes should not be steeper than 1H: 1V, except when the resident engineer approves a steeper cut based upon actual site conditions.
- Excavated material should be hauled away from the site. Stockpiling of the excavated material should be strictly avoided.

B. Piles

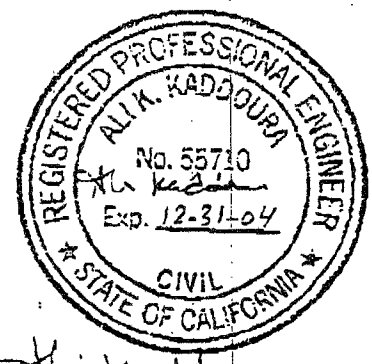
- Installation of CIDH piles should be performed in accordance with Section 49-4 of the Standard Specifications.
- The drilling and concrete placement for CIDH pile construction shall be staggered. No open holes shall be adjacent.

C. Timber Lagging

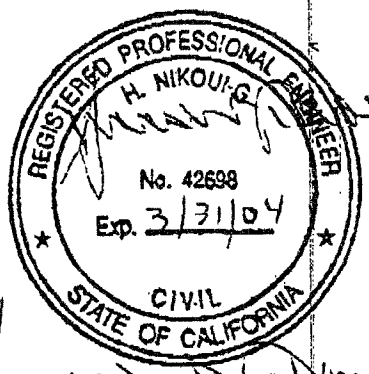
- Timber lagging shall conform to details shown on the plans and the provisions in Sections 57, "Timber Structures," and 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications and these special provisions.
- All timber members shall be preservative treated Douglas fir of the grades shown on the plans.
- Preservative treatment shall be creosote, creosote-coal tar solution, creosote-petroleum solution (50-50), or pentachlorophenol (heavy oil borne) preservative. Preservative treatment shall be for below ground use.
- Timbers shall be installed with ½-inch gap between lagging members.
- Full compensation for filter fabric shall be considered paid per thousand-foot board measure for timber lagging and no separate payment will be made therefor.

● ● ● ● ● ●

If you have any questions or need additional information, please call Ali Kaddoura / Mohammad Zabolzadeh at 8-541-4676 / 4831 or Hooshmand Nikoui at 8-541-4811.



ALI KADDOURA
Associate Materials & Research Engineer



HOOSHMAND NIKOUI, Chief
Geotechnical Engineering Branch 3

AK/MZ:ak
Attach.
cc: RBibbens, GGuiterez (Design), SNg/ARezaee (Maint.), CCashin (Hydraulics), HNikoui, MZabolzadeh, AKaddoura, Project File, Daily File, RGEN.04

REFERENCES:

Mualchin, L. and Jones, A.L., 1992, Peak acceleration from maximum credible earthquakes in California (rock and stiff-soil sites) (prepared for internal use by Caltrans): California Department of Conservation, Division of Mines and Geology Open-File Report 92-1.

Huffman, M.E., and Armstrong, C.F., 1980, Geology for planning in Sonoma County: California Division of Mines and Geology Special Report 120, pl. 2B and 3B scale 1:62,500.

Caltrans EXPLORATION BORING FIELD LOG

Date 1-25-01 | Boring No. P-1

Location Monte Rio | Log No. 9598 | EA No. 153001 | Page 1 of 2

Dist. 04 Co. Son Rte. 116 P.M. 7.0 Br. No. | Purpose of Work Slide

1.8 m Rt. (Lt) Line. Sta. 11+15 Northings. Eastings. Elev.

Date / Time	Water Level	Bot. of Boring
	Dry	18.5'

Logged By: ali K.

Drill Crew: Larry wilson + crew

Drill rig: CS 2000

Hammer Type and Weight:

Drilling Method:

Casing:

Hole Completion:

Depth	Sample Interval	Total Blows / RQD	Sample I.D.	% Rec.	Strength	Graphic Log	Description	moist	Remarks
1							Auger thru (WB116) AC pmt.		bags @ 5 +15'
2									
3							sandstone, tan to brown,		
4							intensely weathered, very soft, very thinly bedded, moderately		
5	1	5	A	70			fractured, fine grained	9.8	
		6							
6		7							
7							Same, more intensely		
8							weathered, more clay, moist		
9									
10	2	4	A	70					
		6							
11		7						12.5	
12							mudstone, black to brown,		
13							very soft, very intensely		
14							weathered, very intensely fractured, fracture zone		
15	3	6	A	90			fractures open thin filled w/		
		11					clay, orange brown low to	12.9	
16		10					mod. plasticity (qc=2.0tsf)		
17									
18							Same, harder, less weathered,		
19							similar fracturing, clay filling (4mm max)		11mm No way
							moist,		
20	4	10	A	90				12.4	
		13							
21		13							
22									
23									
24							Same, more oxidized,		
							slightly sandier		
25	5	9	A	80			(qc=1.75)	14.7	
		17							
		24							
27									
28									
29									

Caltrans	EXPLORATION BORING FIELD LOG.	Date 1-25-01	Boring No. P-1

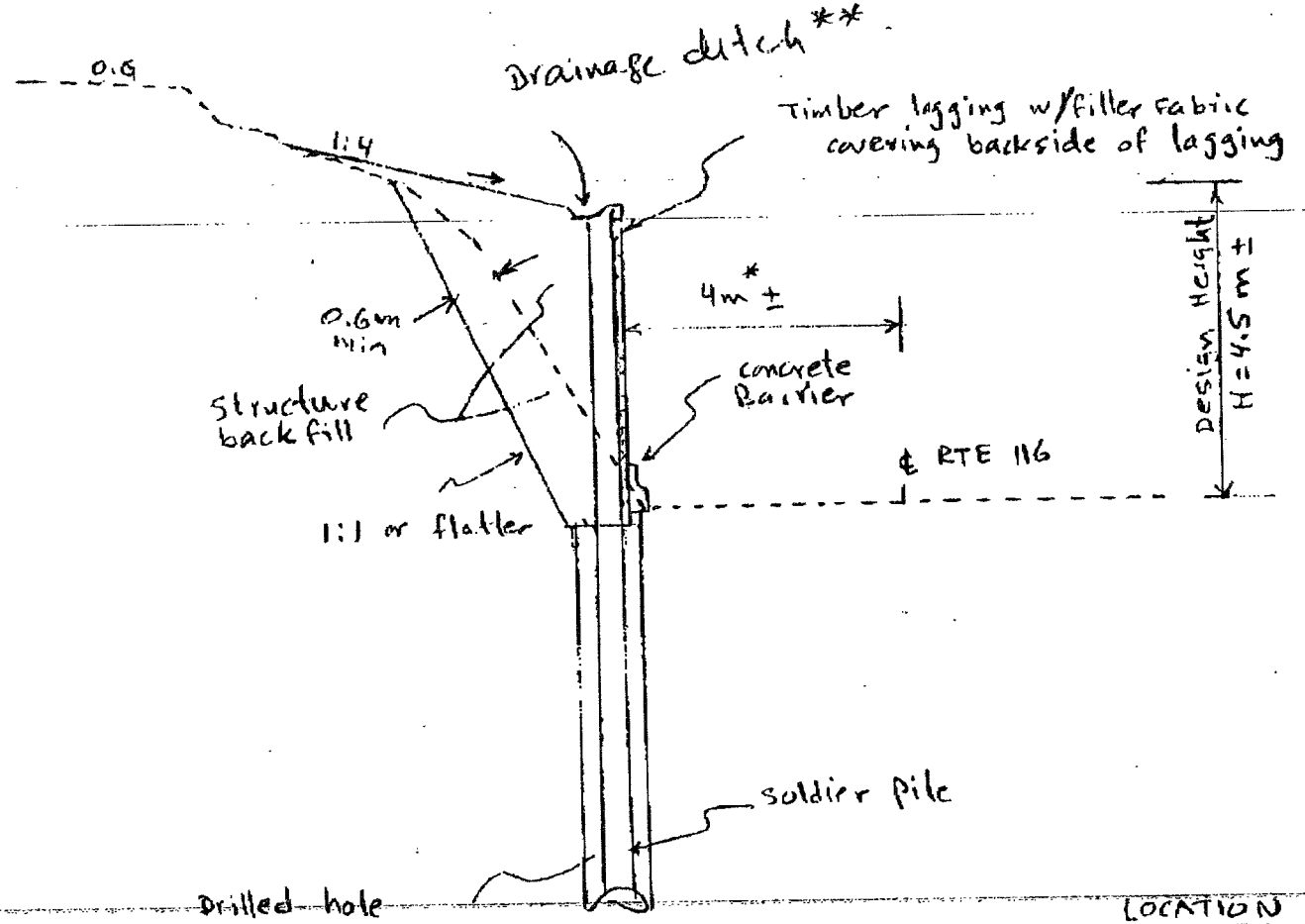
Location: Mato Rio — Lab No. 9598 — EA No. 153881 — Page 2 of 2

Dist. 04 — Co. Son — Rt. 116 — P.M. 7.0 — Br. No. — Purpose of Work:

Ft., Rt./Lt. — Line, Sta. — Northings. — Eastings. — Elev.

Ground Water Data: Date	Time	Water Level	Bot. of Boring	
				Logged By: — Drill Crew:
				Drill rig: — Hammer Type and Weight:
				Drilling Method: — Casing:
				Hole Completion:

Depth	Sample Interval	Tool	Blows	RQD	Sample I.D.	% Rec.	Strength	Graphic Log	Description			Remarks
29									same, black, mod. weathered,			
									very soft, very intensely			
30			7		A	80			fractured. fractures open,		6.7	
	6		22						filled with grey clay,			
31			46						moist, med. plasticity			
32'												
34									same, black, very intensely			
									weathered, very soft,			
35			5		A	50			very intensely fractured,		12.8	
	7		9						wire clay (dark to dk grey)			
36			10						in open fractured zones.			
									Boring @ 36'			
									(Hole caved @ 18.5')			



* To be determined by Design North
** To be designed by Hydraulics Branch

TYPICAL SECTION

NO SCALE

LOCATION 2

EXHIBIT A

04-Son-116 PM 7.0 (KP 11.3)

153001 Feb. 2001

METRIC

State of California

Business, Transportation and Housing Agency

Memorandum

To: MARK RENO – MS #9
Design Branch 5

Attn: Manode Kodsuntie

Date: July 19, 2001

File: 04-SON-116 KP 11.3
EA 04-1S3001

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
MATERIALS ENGINEERING AND TESTING SERVICES - MS #5

Subject: Corrosion Review for Route 116 Slide Repair

I have completed my corrosion review of the proposed slide repair strategy for Route 116, KP 11.3 at Monte Cristo Avenue in and near the towns of Villa Grande and Monte Rio in Sonoma County.

Information that I used for my review included a repair strategy memo dated February 20, 2001 from Ali Kaddoura (Geotechnical Engineering Branch 3) to Clark Peri (Project Coordination Engineer), corrosion test results for soil samples obtained from the site, and the California Department of Transportation (Department) BDS Article 8.22 (July 2000).

Project Description

The project site is approximately 6.4 miles east of the entrance of the Russian River near the coast. Subsurface material in the area is described as predominately graywacke-type sandstone and shale with minor greenstone, conglomerate, chert and limestone.

It is my understanding that work at the slide site will include constructing a soldier pile wall consisting of steel H-piles (installed in drilled holes) with concrete encasement. The concrete encasement will consist of Class 2 structural concrete for the portion of the steel piling within the drilled hole, and lean concrete near the base of the wall for portions of the piling exposed to the embankment slope. Portions of the lean concrete will be removed after placement to facilitate the attachment of timber lagging.

Corrosion Review

The Department defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-cm, or a pH of 5.5 or less.

A total of five surface and subsurface soil samples were obtained and tested for pH, minimum resistivity, sulfate concentration, and chloride concentration in accordance with CTM 643, CTM 417, and CTM 422. Soil corrosion test results were as follows:

Soil pH ranged from 4.3 to 5.8, minimum resistivity of the soil ranged from 3050 ohm-cm to 7260 ohm-cm, sulfate concentration of the soil ranged from 32 ppm to 42 ppm, and chloride concentration (of each sample) was less than 30 ppm.

Based on the above test results, the soil at this site is considered corrosive due to the low levels of pH.

Corrosion Recommendations

- In accordance with BDS Table 8.22.2 (July 2000), corrosion resistant concrete, consisting of mineral admixtures and a reduced water-to-cementitious material ratio, is needed for all structural concrete (including the encasement concrete within the drilled holes) to mitigate the low pH of the subsurface soils at this site. Reference Specification S8-C 04(90CORR), Corrosion Control for Portland Cement Concrete, should be used to ensure compliance with the requirements of BDS Article 8.22 for corrosion protection. Tom Ruckman (916-227-8591) of the Structures Specifications Branch should be contacted for assistance related to Reference Specification S8-C 04 (90CORR).

- Lean concrete at the base of the wall will not (by itself) provide sufficient corrosion protection against the low pH of the embankment soils at the site. In order to provide additional corrosion protection of the steel piling within this zone, the steel piling should be painted with inorganic zinc paint in accordance with the Department's Standard Specifications, Section 59-2.13, Application of Zinc-Rich Primer.

If you have any questions regarding these recommendations, please contact me at (916) 227-7287.

ROBERT A. REIS, P.E.
Senior Materials & Research Engineer (Specialist)
Corrosion Technology Branch

c: Grant Schuster, OSD
Ali Kaddoura - GS
Doug Parks
Arron Rambach
Susan Hall
John Muiruri

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

Date: 11/7/03

Structure Design
1. Design
2. R.E. Pending File
3. Specifications & Estimates
4. File

Retaining Wall @ KP 11.3
Structure Name

Geotechnical Services
1. GD - North ; South ; West
2. GS File Room

07-San-(VC-11.3
District County Route km Post

District Project Development
District Project Engineer

07-173001
E.A. Number Structure Number

Foundation Report By: A Kadura (SD)
Dated: 2/2/03

Viewed By: M Kadsuatin (GS)
R. Price

General Plan Dated: 10/23/03
Foundation Plan Dated: 10/24/03

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- ✓ Pile Types and Design Loads
- ✓ Pile Lengths
- ✓ Predrilling
- ✓ Pile Load Test
- ✓ Substitution of H Piles For Concrete Piles ☐ Yes ☐ No
- ✓ Footing Elevations, Design Loads, and Locations
- ✓ Seismic Data
- ✓ Location of Adjacent Structures and Utilities
- ✓ Stability of Cuts or Fills
- ✓ Fill Time Delay
- ✓ Effect of Fills on Abutments and Bents
- ✓ Fill Surcharge
- ✓ Approach Paving Slabs
- ✓ Scour
- ✓ Ground Water
- ✓ Tremie Seals/Type D Excavation

Structure Design

Branch 5
Bridge Design Branch No.

Geotechnical Services

06/02

FOUNDATION REVIEW

ENGINEERING SERVICE CENTER
OFFICE OF ROADWAY GEOTECHNICAL ENGINEERING - NORTH

Date: 8/9/2001

To: **Office of Structure Design**

1. Preliminary Report
2. R.E. Pending File
3. Specifications & Estimates
4. File

Office of Structural Foundations

1. SFB (Sacramento)
2. SFB (Los Angeles)

District ______ District Project Engineer

Retaining Wall at KP 15.6
Structure Name

04-SON-116 KP 15.6
District County Route Post Mile

04-153001 —
E.A. Number Structure Number

Dated: 8/22/00

Foundation Report By: A. Koddoura / H Nikou (OSD) Gary Garofalo (OSF)

Reviewed By:

General Plan Dated: 7/26/01

Foundation Plan Dated: 7/26/01

☐ No changes. ☑ See notes ☐ The following changes are necessary.

☐ "Difficult drilling spec" - verify it is in the specials, and add language from FR Pg 5
☐ - Verify that staggered holes (Pg 6 of FR) is required in specials

- LOTBs - ok
- Tie back angle - ok
- Unbonded length > min in report ok 7.5m + 0.3 (6m±) ≅ 9.3m ∧ 9m say ok
  no true failure plane; erosion only
- " " beyond active zone -
- Earth Pressure - per report ok, add passive pressure parameters to page 3
- Live Load - per DOS standards - ok
- Seismic Design - done per DOS standards - ok
- Berm width - ok
- Pile compression - ok - done by DOS
- Pile Spacing ≤ 2.2m < 2.5 per report ok
- Drainage / Required provided - yes, per report ok
- Portland cement [illegible] per report ok.
- Embedment from OG (@ top of wall) - ok - per report

☑ - Verify that sandstone is being referred to on Pg 5 of FR, as it is not shown on LOTB
Per Ali Koddoura on 8-15-01 change wording in FR from "sandstone" to "shale"

FOUNDATION CHECKLIST

✓	Pile Types and Design Loads	NA	Footing Elevations, Design Loads, and Locations	NA	Effect of Fills on Abutments and Bents
✓	Pile Lengths	✓	Seismic Data - in report ok	NA	Fill Surcharge
✓	Predrilling - yes CIDH	NA	Location of Adjacent Structures and Utilities	NA	Approach Paving Slabs
NA	Pile Load Test	NA	Stability of Cuts or Fills	NA	Scour
NA	Substitution of H Piles For Concrete Piles ☐ Yes ☐ No	NA	Fill Time Delay	NA	Ground Water
				NA	Tremie Seals/Type D Excavation

[signature] Office of Structure Design

5 Section No.

Gary Garofalo - Geotech North
Office of Structural Foundations

Rev. 04/95

State of California

Business, Transportation and Housing Agency

Memorandum

To: MARK RENO
Division of Structural Design,MS9-4/11G
Design Branch A

Date: April 4, 2001

File: 04-Son-1-KP 15.6
EA: 04-1S3001

Retaining Wall at KP 15.6
Bridge No. 20-RW01

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
OFFICE OF MATERIALS ENGINEERING AND TESTING SERVICES – MS #5
TESTING AND TECHNOLOGY SERVICES BRANCH

Subject: **Corrosion Review for Retaining Wall at KP 15.6**

We have completed our corrosion mitigation review of the Retaining Wall at KP 15.6 project outlined in a February 28, 2001 memorandum sent to Doug Parks of the Corrosion Technology Section. Our review is based on corrosion test results of soil samples, project design plans, the memo titled "Slide Repair Foundation Recommendations", summarized information from the log of test borings, the Memo To Designers 10-5 (MTD 10-5 December 2000 draft), The Caltrans Standard Specifications (July 1999), and Caltrans Bridge Design Specifications Section 8.22 (December 2000 draft).

Project Description

During heavy January/February 1998 rainstorms, a slipout occurred along the southbound lane of Route 1, KP 15.7, about 0.16 km north of Smith Brothers Road-North, in the town of Bodega Bay in Sonoma County. The slipout encroached approximately 0.2 m into the southbound lane and damaged the existing metal beam guardrail (MBGR). The approximate limits of the slipout are between Stations 397+54 and 397+79. The cause of the slide appeared to be surface water runoff during heavy rainstorms.

The design portion of this project was contracted out in 1998 to consultants Mark Thomas and Co., Inc. However, the consultants stopped work on this project due to lack of funds. District 4 management decided to keep the project and prepare the final PS&E package in-house. The consultants forwarded all available incomplete design data to Caltrans.

Two alternatives are presently being considered for this project. Alternative 1 is a soldier pile wall with timber lagging. The H-piles are Cast-in-drilled-hole (CIDH piles). The H-piles are to be covered with a reinforced concrete/shotcrete architectural treatment stained and textured to give the appearance of real timber. Alternative 2 is also a soldier pile wall with timber lagging. The H-piles are Cast-in-drilled-hole (CIDH piles). Stained and/or textured reinforced concrete/shotcrete architectural panels are proposed to cover the entire wall.

Corrosion Review

Caltrans defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-cm, or has a pH of 5.5 or less.

Two borings were taken at the Retaining Wall at KP 15.6 project site by the consultant (Borings P-1 and P-2). Corrosion tests were conducted in accordance with Caltrans Test Method CTM 643. The pH level of the soil ranged from 7.5 to 8.4. The minimum resistivity of the soil ranged from 1353 to 2218 ohm-cm.

We have reviewed the site-specific information and the corrosion test results. Based on the corrosion test results, the soil on-site is not corrosive. Groundwater was not encountered at the site. The site lies adjacent to Bodega Bay, but, the wall is not in direct contact with the seawater. In addition to the non-corrosive soil conditions, it is not appropriate to define the site as a splash zone. The site is located within a corrosive marine atmosphere.

Corrosion Recommendations

In order to maintain a 75-year design life for the structure, we recommend the following corrosion mitigation measure options:

- For all concrete structures the minimum concrete cover requirements for chloride environments are addressed in Table 8.22.1 of the BDS (December 2000 draft). The minimum concrete cover for exposed architectural treatments, and CIDH piles shall be 76 mm (3 inches).
- All concrete structures shall contain 75% by mass portland cement and 25% by mass mineral admixture conforming to ASTM Designation C618 Class F or N (fly ash or natural pozzolans) and in accordance with SSP S8-CO3(90CORR)_R12-20-00.DOC. Minimum cementitious material content shall be 400 kg/m^3.
- The H-piles shall be coated with an inorganic zinc-rich primer and finish coating in accordance with Reference Spec 55-600(55SENC)_R01-12-01.DOC.

If you have any questions regarding our comments, please contact Michael Tolin at (916) 227-5297 or Doug Parks at (916) 227-7007.

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